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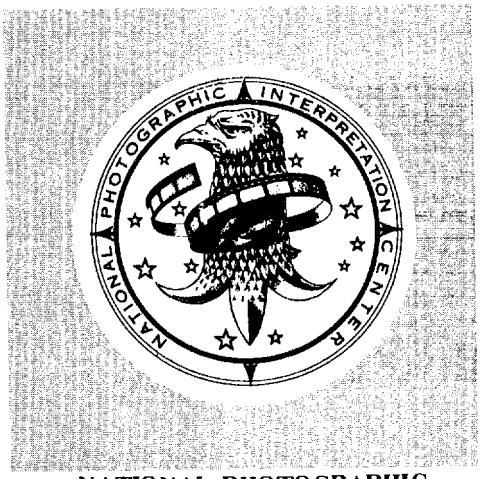

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TECHNICAL PUBLICATION

TEST AND EVALUATION REPORT

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MIM-3 LIGHT TABLE MODIFICATION

NPIC/R-04/74
FEBRUARY 1974

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Comments and queries regarding this report are welcomed.
They may be directed to [redacted]
NPIC/TSG/ESD/TEB, [redacted]

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE OF CONTENTS (Continued)

2. DESCRIPTION OF EQUIPMENT CHANGES

2.1 General

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The modified [redacted] MIM-3 light table is shown in Figure 1. The modifications are intended to: (1) make viewing the various film formats more convenient, (2) increase the light output, (3) provide additional stiffening to the optics carriage, and (4) improve the film handling characteristics.

2.2 Film Viewing Section

- The two light stages were replaced by two larger stages to permit viewing two parallel strips of 6.6-inch film.
- Each stage has two separately powered fluorescent tubing sections controlled by a common dimmer. The outboard section may be turned off when desired. The original Hi-Lo intensity switch control is retained.
- Each stage is air cooled by a variable speed fan.
- Roller-shade type masking has been added between the light sources and the glass table tops.

2.3 Film Handling System

- Longer "T" rails and film rollers have been installed to meet the requirement for increased film width capabilities. The "T" rails include a new detent system to aid in positioning the film drive motors and spindles.
- Four film transport motors with control circuitry have been added. Each motor has a built-in film loading spindle. The two motors located at the rear of the top "T" rail assembly can be moved to the lower "T" rail for split-vertical operation.

1. INTRODUCTION

STAT A [redacted] MIM-3 light table (GFE) was modified [redacted] STATINTL
STATINTL [redacted] These modifications give this newly configured light table many film viewing and handling features found on conventional 1540 light tables. The modified MIM-3 table retains most of the original structural assemblies.

STATINTL [redacted] the Test and Evaluation Branch, ESD/TSG/NPIC, conducted an engineering test and evaluation of this preproduction light table (the first of 26 units to be modified by the contractor) to document the physical characteristics and operating parameters. These tests were performed during the period 17 to 26 September 1973. They were confined primarily to the new modifications and to parameters affected by the modifications.

- Although the film takeup loop mechanism remains basically unchanged, both stages are now equipped with stage shifter mechanisms to facilitate film loading.

2.4 Microstereoscope Carriage Modifications

The carriage remains unchanged with the exception of the following modifications to the Y axis:

- The power cables for the Y-axis carriage clutch have been replaced by an exposed low voltage contact strip and brush assembly.
- Auxiliary flat rails which carry additional carriage rollers have been added to each Y-track end plate. They provide added stiffness to compensate for the increased Y motion.

2.5 Miscellaneous

These additions replaced the original components:

- A new power supply box for the light stages, fans, and film drive motors.
- A new control box for the light stages and the film drive motors.

3. CONCLUSIONS AND RECOMMENDATIONS

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- The Modified [redacted] MIM-3 Light Table performed satisfactorily during the test and evaluation program. No major problem areas were uncovered.

- A better dust seal is needed between the left light box and the glass stage.

- A safety interlock should be installed in the power supply box on this table and on all additional light tables to be modified.

- Identification markings are needed for the four fuses.

4. TEST RESULTS

4.1 External Configurations

- Identification

  Old Nameplate: GFL-940 MCE Light Table
  Catalog No. 951596 S/N 01254

  New Nameplate: MIM 3410P Light Table
  No catalog or serial numbers

- Size

  Width: Including film drive motors and reel brackets - 57.5 inches.

  With reels and brackets removed - 43.0 inches.

  Depth: With film drive motors in place - 32.5 inches.

  With motors re-positioned on "T" rails 30.5 inches.

  Overall Height:

  With table raised - 65.0 inches.

  With table lowered - 48.2 inches.

  Table Top Height:

  With table raised - 44.5 inches.

  With table lowered - 27.5 inches.

  Table Top Depth:

  23.6 inches.

  Light Box Thickness:

  5.5 inches.

4.2 Weight

500 pounds.

4.3 Power

- Input Requirements at 117 VAC

  With both stages maximum brightness - 8.45 amperes, 610 watts

  With both stages maximum brightness and two film drives operating - 8.60 amperes, 630 watts

4.4 Film Viewing System

- Stage Size

  The illuminated area of each stage is 14.12 by 17.25 inches. Their combined width is 36.00 inches.

- Luminance Levels*

	Dimmer Control	Hi-Lo Switch	Left Stage Inboard	Left Stage Both	Right Stage Inboard	Right Stage Both
Left Stage Only	Max.	Hi	2800	3100		
Right Stage Only	Max.	Hi			2900	3050
Both Stages	Max.	Hi	2800	2975	2875	2975
Both Stages	Min.	Hi	740	740	650	740
Both Stages	Min.	Lo	180	190	170	200

* Above readings are in footlamberts. They were taken with a [redacted] Model 759 footlambert meter, Serial No. 1080.

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- Luminance Distribution (Brightness Gradient)

With all intensity controls set at maximum, the luminance was measured at 36 points, spaced uniformly over the entire area of each stage. The resulting contour plots in Figures 5 and 6 show a reasonably even distribution over most of the surface area.

- Color of Illumination

These measurements were made at maximum stage brightness with a Gamma Spectroradiometer.

Left Stage	Right Stage
Correlated color temperature: 5747 Kelvins	Correlated color temperature: 5633 Kelvins
Chromaticity coordinates: X = .3266 - Y = .3613	Chromaticity coordinates: X = .3296 - Y = .3629
Color rendering index: 74.5	Color rendering index: 74.6

- Luminance Stability

Both stages reached their maximum brightness after approximately 6 minutes of operation. Characteristic curves of luminance versus time are shown in Figure 7.

- Flicker

No bothersome flicker was noted during the course of the test program.

- Temperature Rise

Temperature rise characteristics were determined by cementing a thermocouple to the emulsion in the central portion of a 6.6-inch-wide piece of 1.7 density film. This film piece was placed in the forward position on the stage with the remainder uncovered. The

temperature was then read on a [redacted] digital thermometer. The temperature rise characteristic curve for the left stage is shown in Figure 8. It can be seen that thermal equilibrium is achieved after 2 hours of operation. The right stage did not perform noticeably different.

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- Luminance Controls

The luminance control characteristic curve for the right stage is shown in Figure 9. Note how the hi-lo switch must be used in combination with the dimmer control to achieve full-range luminance control.

- Luminance Versus Line Voltage

Variation in input line voltage causes a change in the brightness of each stage. Curves depicting the luminance level as a function of line voltage are shown in Figure 10. Since the light table does not employ a regulated power supply in this circuit, variations of this type can be expected.

- Light Shades

Each stage contains a rollup type shade between the top surface and the luminance source. It is extended from the rear to the front of the table by means of two thumbwheels located near the ends of the table. These shades mask to within 1-5/8 inches of the front edge of the stages.

4.5 Film Handling System

- Film Accommodation

Film Widths: A modified "T" rail system (Figure 2) has been incorporated which allows dual web handling of film widths from 70 mm to 6.6 inches. Single web and split vertical film handling can be accommodated for film widths up to 9.5 inches.

Brackets: The "T" rail and bracket assembly includes an indexing detent system which allows positive positioning of the film motors and brackets for the various film width combinations. The notched plate and latching lever on top of the "T" rail shows clearly on Figure 3. A visual reference scale also aids in this positioning. No problems were encountered in proper positioning of any bracket or motor. Film spool diameters up to 7.5 inches can be accommodated on these brackets.

Film Loading: The film drive motors each incorporate a spindle mechanism for film loading (Figure 3). This mechanism operated quickly and positively and allowed easy loading and unloading of the film spindle. A force of 8.5 pounds and 1.6 pounds, respectively, is required to open and close the mechanism. The throw for opening and closing the mechanism measured .87 inch.

- Film Looping

The viewing stage shifter mechanism produces an outward shift of each stage to provide an opening between the stages for loading a film loop. When open, this slot measured 1.32 inches and when closed, .17 inch. This mechanism is capable of forming a loop of film 18 inches to 70 inches in total film length.

- Rollers

The length of the film rollers has been increased from 10.5 inches to 15 inches to accommodate the various film width combinations now encountered.

- Film Movement

Film Drive System: The film drive motors are activated by two continuously variable controls. They exhibited a large lag near their center of rotation and, therefore, do not yield positive control and positioning at the slow film scan speeds. However, better control would probably require the drive motor circuitry to be equipped with feedback controls such as tachometers, generators, etc.

High Speed Translation: The maximum time required to translate 500 foot rolls of 70 mm and 6.6-inch film is 57 seconds. A 500-foot-roll of 9.5-inch film can be translated in 75 seconds. Film speed falls to approximately 6 feet per second near the end of a 9.5-inch spool of film.

Film Tracking: The system exhibited satisfactory film tracking characteristics for all film sizes with the exception of the 70 mm film. This film had a tendency to track so hard against one flange of the takeup spool as to wrap unevenly.

- Film Tension

Tension ranged between 1.3 and 1.8 pounds for a 500-foot spool of film. This amount of tension is sufficient to prevent slack loops from forming when the film is decelerated.

4.6 Microstereoscope Carriage

- Carriage Locks

Newly installed low voltage contact strip and brush assembly applies power to the Y carriage lock. This assembly is shown in Figure 2. No problem was encountered with it during the testing program. Minimum force required to move the carriage with both locks engaged was 12 pounds in the X direction and 10 pounds in the Y direction.

- Carriage Travel

The Y direction carriage travel of 14.25 inches is sufficient to cover the full depth of the stage viewing surface. The overall travel in the X direction measured 26.5 inches.

- Carriage Forces

The force required to manually start the carriage in the Y direction averaged 2.5 pounds. Forces required

to keep it in motion averaged 2.4 pounds. Motion in the X direction can be started by an average force of 1.2 pounds. Forces averaging 0.9 pound are required to maintain this motion. These carriage forces are judged to be satisfactory. No excessive binding was noted over the range of X and Y travel.

- Carriage Parallelism

The variation in distance between the stereoscope mount and the stage surface was measured at 36 grid point locations on each stage. These measurements were made with a simulated mount load of 9.4 pounds. Contour plots based on these measurements are shown in Figures 11 and 12. These plots show that the two stages are reasonably parallel to the microscope mount.

- Vibration

Vibration analysis consisted of locating the modified MIM-3 light table adjacent to an [redacted] 1540 light table and comparing their vibration characteristics. A vibration target was viewed on each table at 60X magnification with the [redacted] Zoom 240 microstereoscope. Vibrations subjectively appeared about the same for both tables. However, when the [redacted] 1540 table was tilted slightly, its vibration appeared significantly less than that of the modified MIM-3 table.

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- Carriage Stiffening

A 1/4- by 1- by 18-inch flat metal plate is attached to each end plate parallel to the original Y rail (see Figure 2). A 7/8-inch diameter wheel rides on the top of this stiffening rail for additional Y motion carriage support. It is assumed that this was done to compensate for the increased Y travel.

4.7 Human Factors

- General

The human factors examination was accomplished with the aid of a human factors checklist for light tables STAT [redacted] DK-664). No problem areas were uncovered as a result of this examination.

- Maintenance

Figure 4 shows the layout of electronic components located within the power supply box. They are readily accessible for troubleshooting. All components can be easily removed or replaced except the top four transformers. Their upper mounting screws are inaccessible.

Four fuses are located on the left side of the power supply box. They are accessible, but the function of each fuse is not identified on the mounting panel.

Film tracking adjustment can be accomplished by loosening a locking screw (Figure 3) and moving the detent rail slightly.

- Safety

The modifications did not introduce any new safety hazards. The maximum electrical leakage current was measured to U.S. Standards Specification C101.1. It measured 0.51 milliamperes, which is well below the 0.75 milliampere limit set forth. This means that the light table would not be dangerous in the event that it was inadvertently operated from an ungrounded wall outlet. However, an interlock switch is needed to prevent inquisitive persons from coming in contact with high voltages present in the power supply box.

4.8 Other

A polyurethane seal located between the left light box and the glass stage does not make full contact with the glass surface. Dust may be drawn into the light box through this opening.

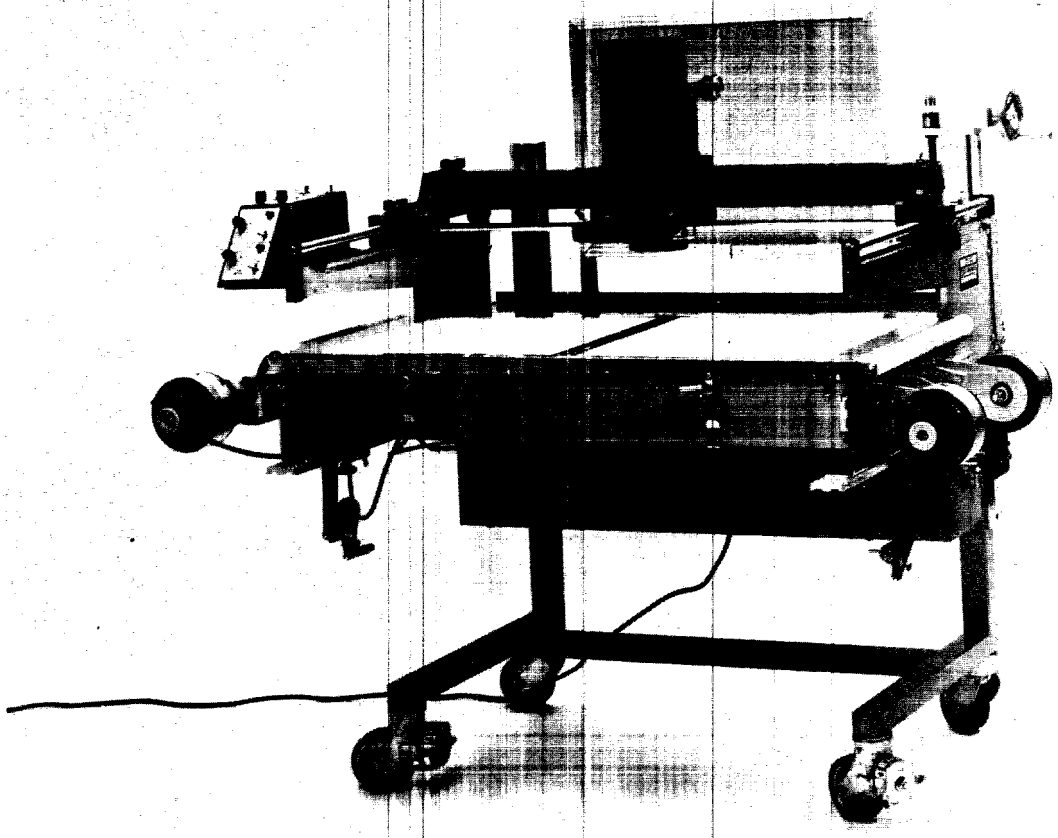

FIGURE 1. Modified MIM-3 Light Table

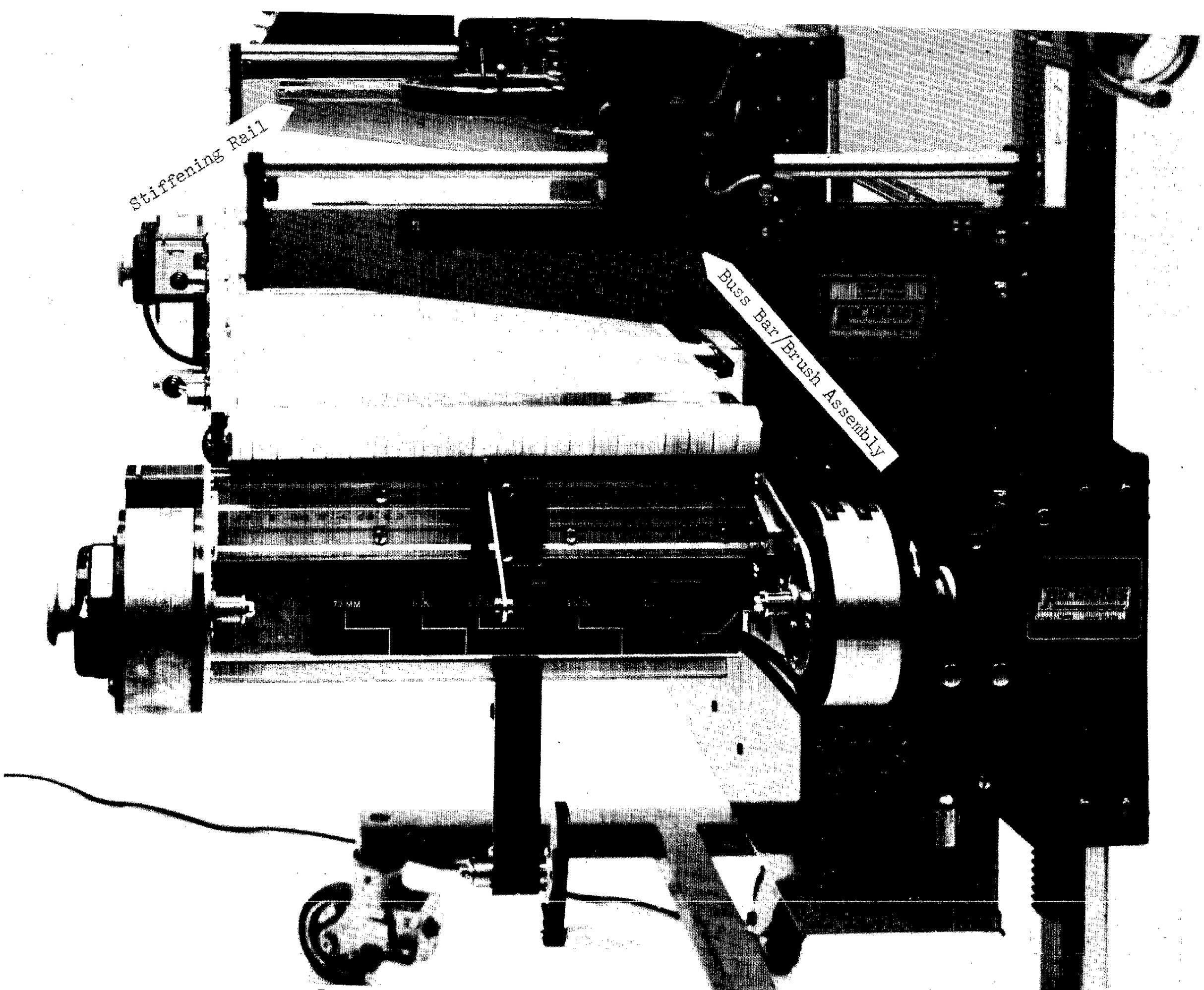

FIGURE 2. Light Table - End View

FIGURE 3. Light Table - Film Drive Motor

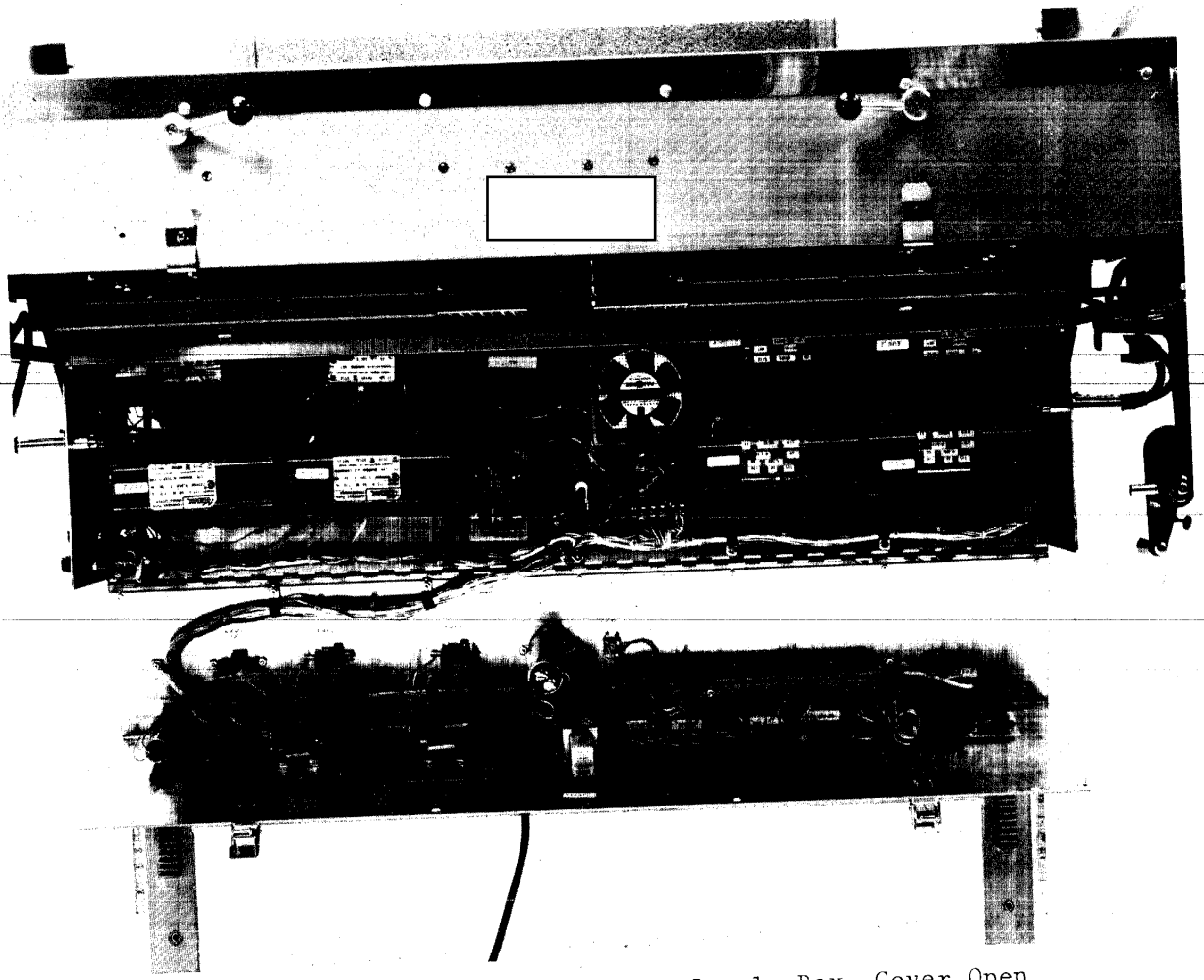

FIGURE 4. Light Table - Power Supply Box, Cover Open

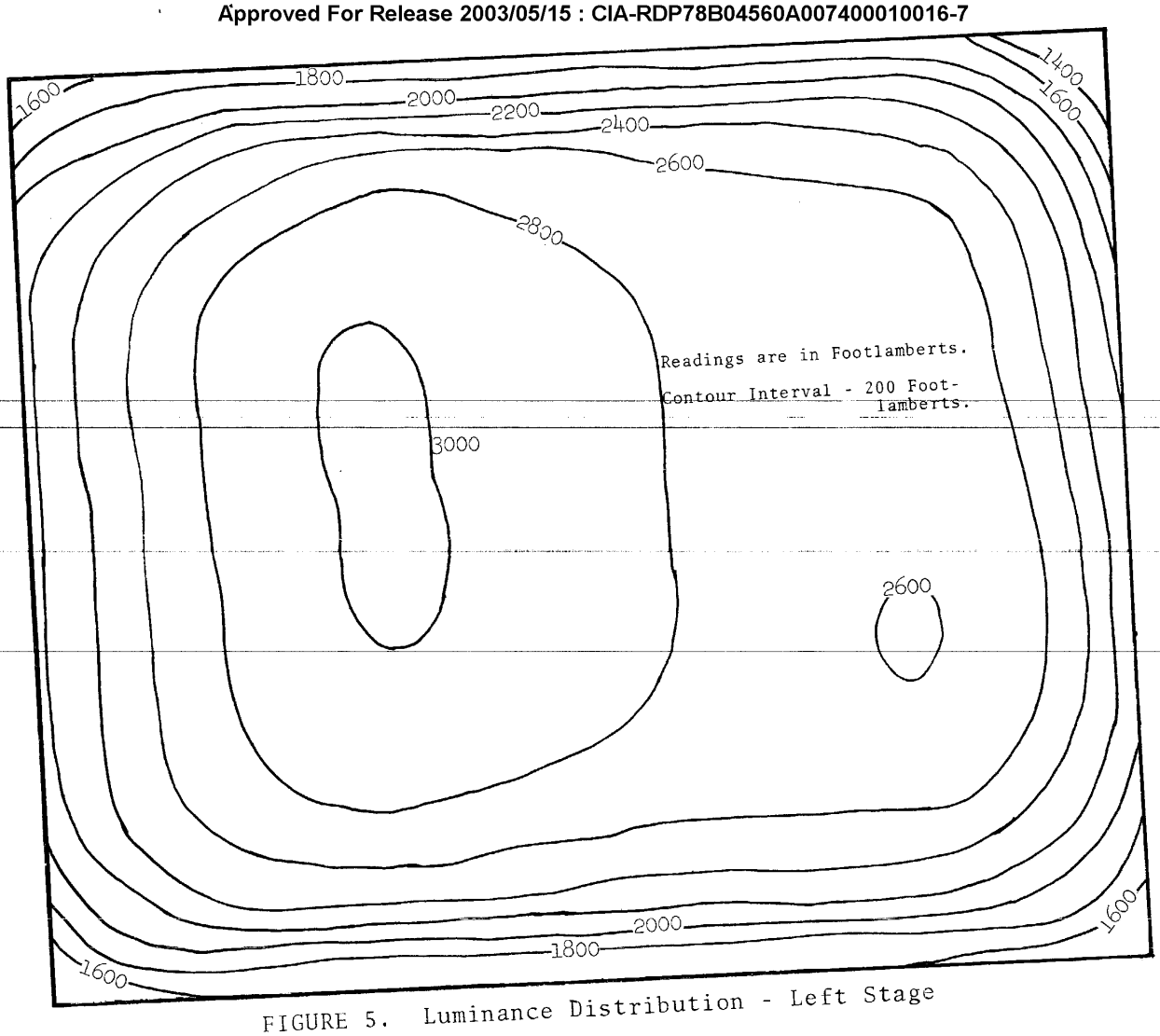

FIGURE 5. Luminance Distribution - Left Stage

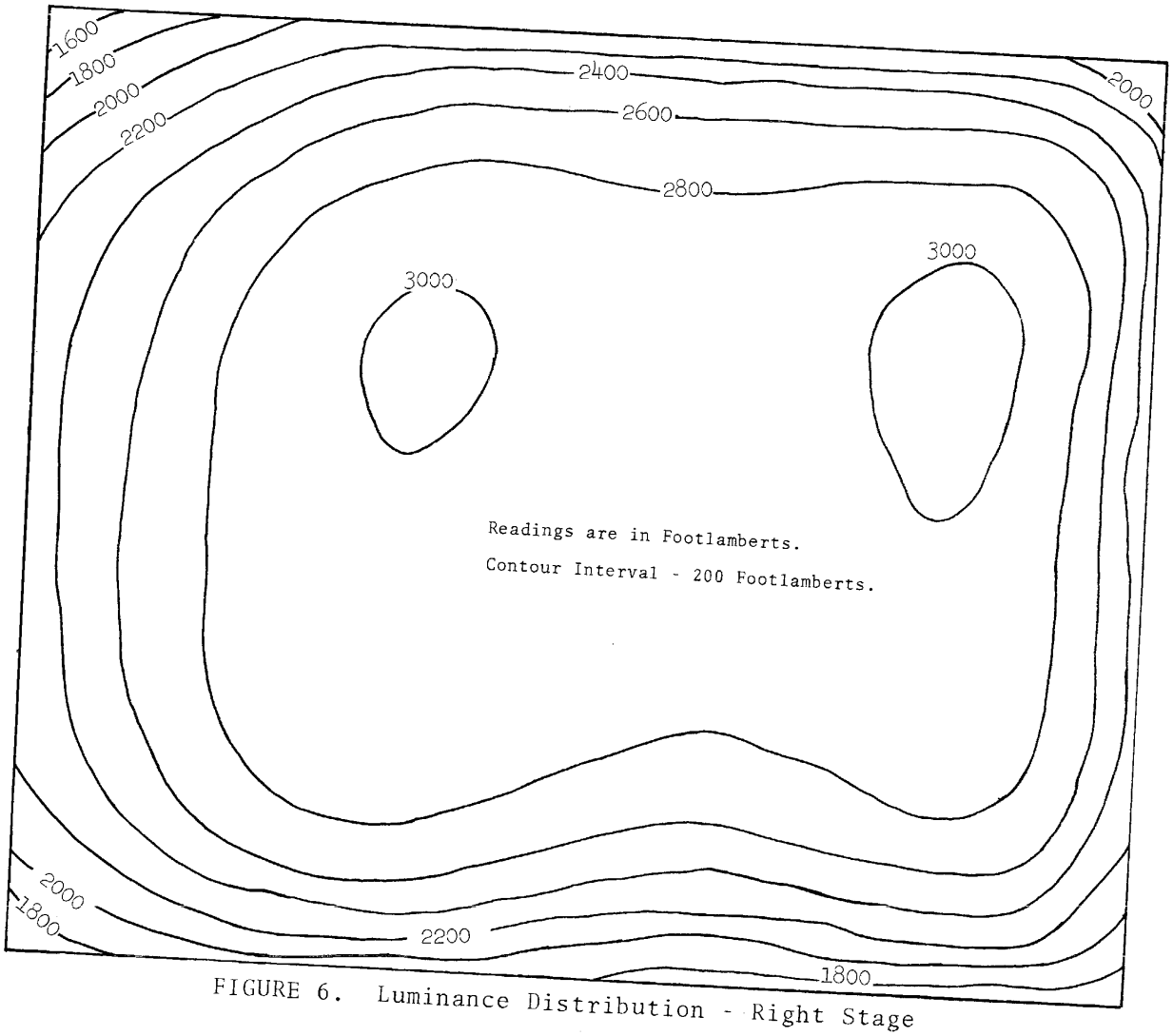

FIGURE 6. Luminance Distribution - Right Stage

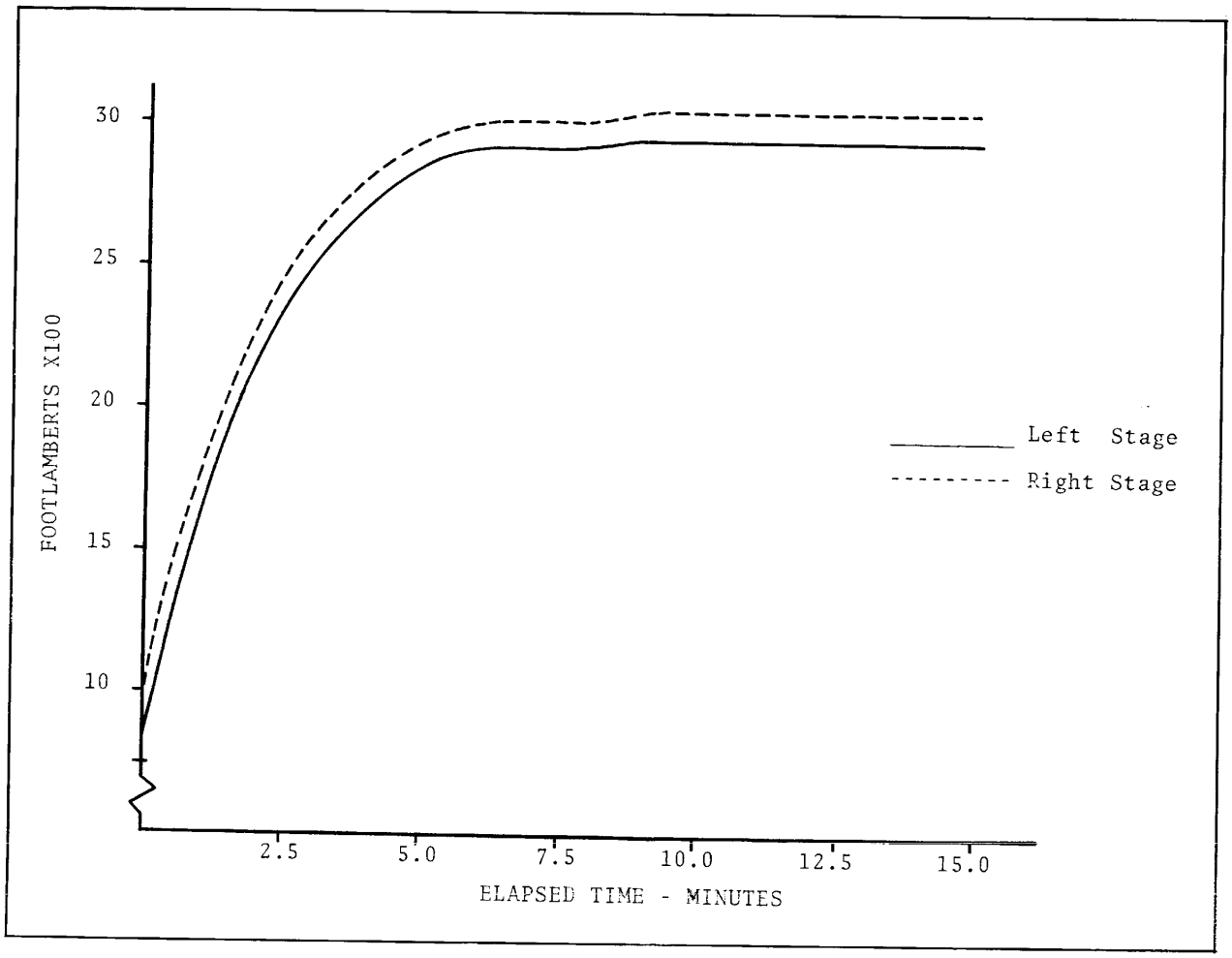

FIGURE 7. Luminance Level Versus Time

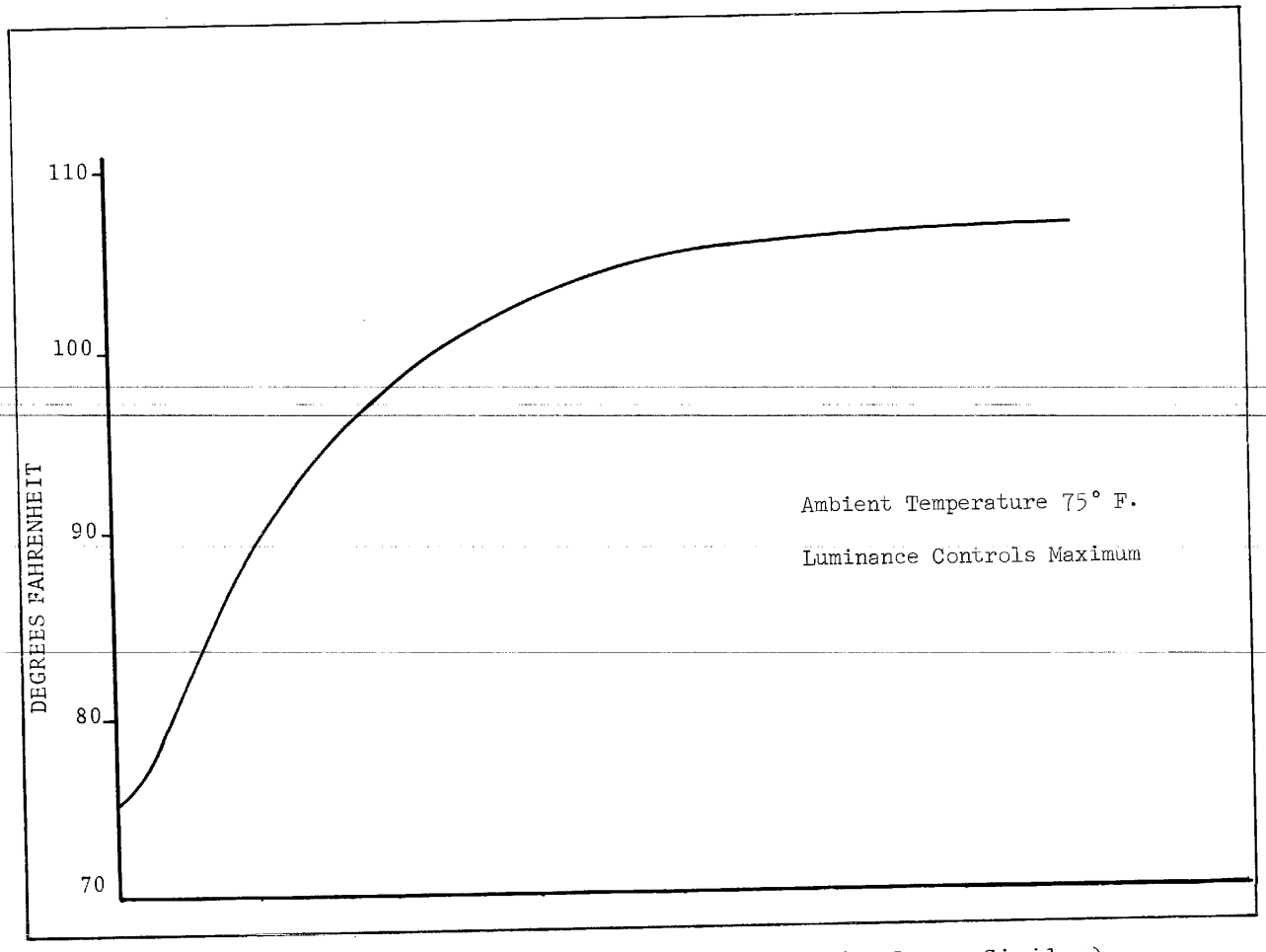

FIGURE 8. Temperature Rise - Left Stage (Right Stage Similar)

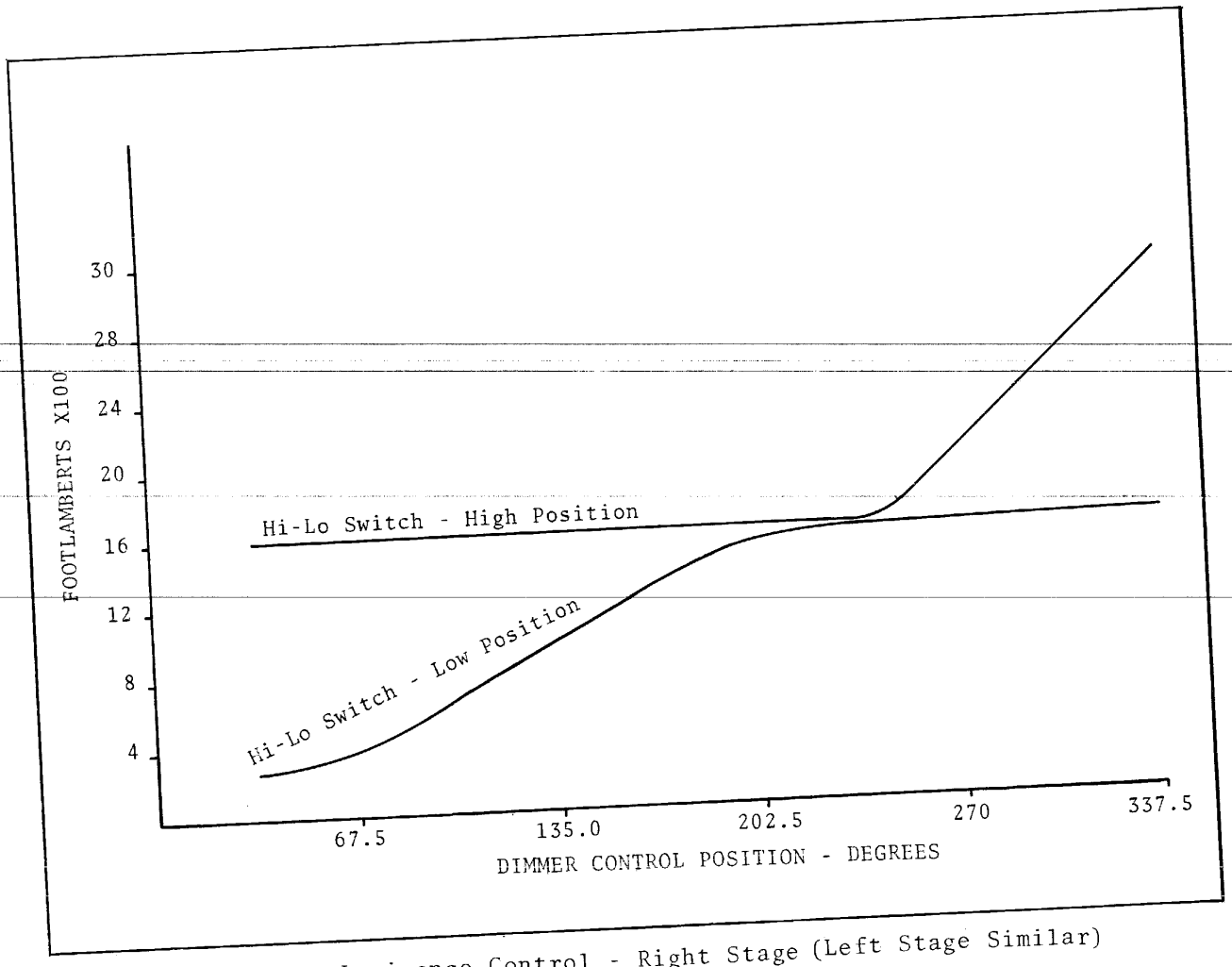

FIGURE 9. Luminance Control - Right Stage (Left Stage Similar)

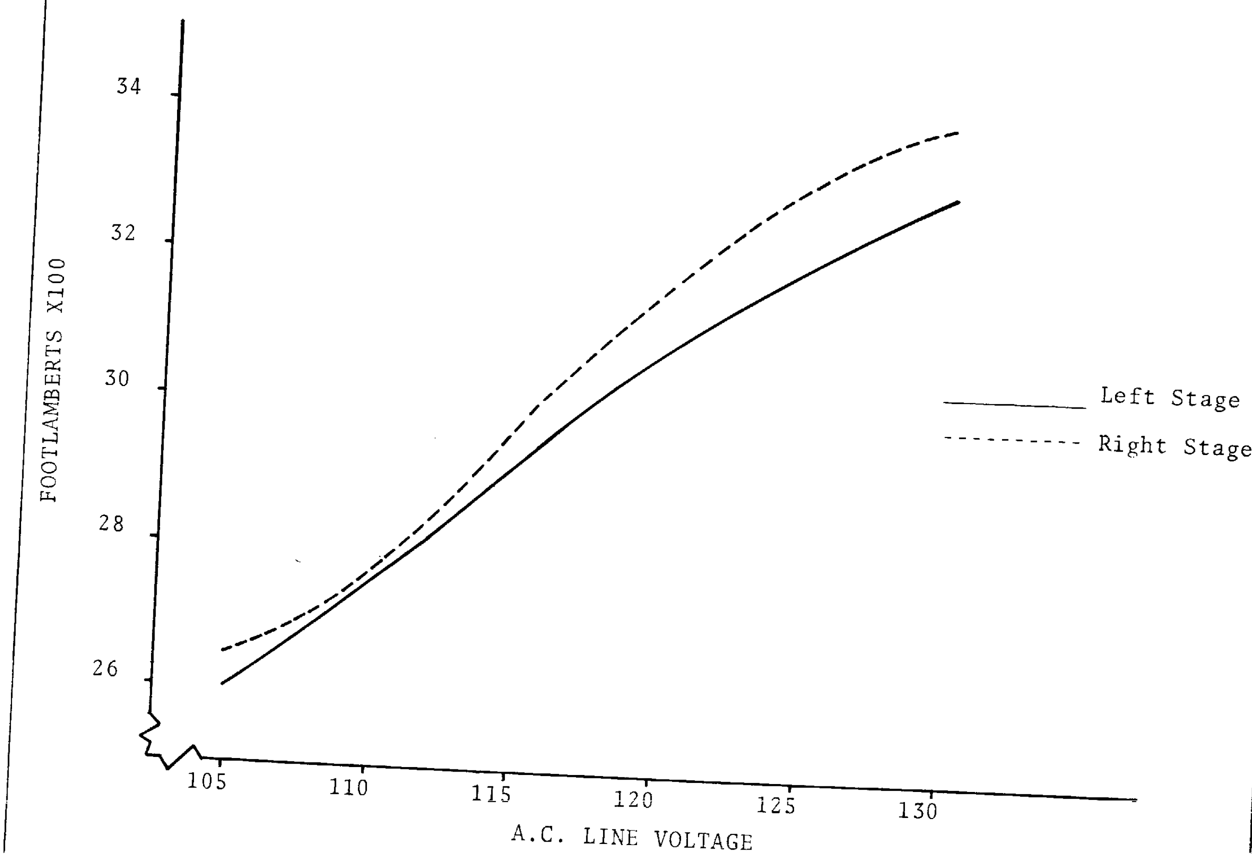

FIGURE 10. Luminance Versus Line Voltage

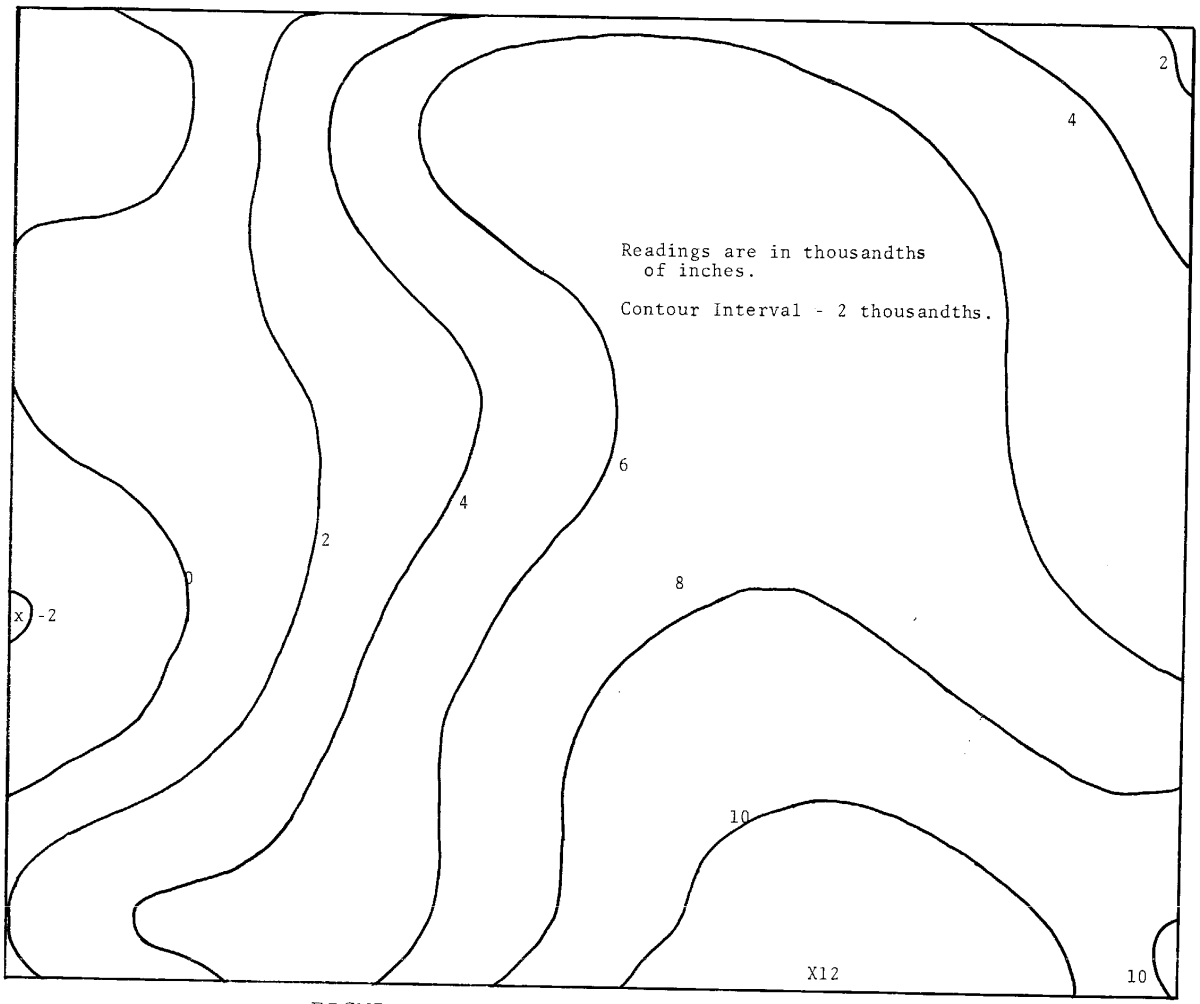

FIGURE 11. Parallelism - Left Stage

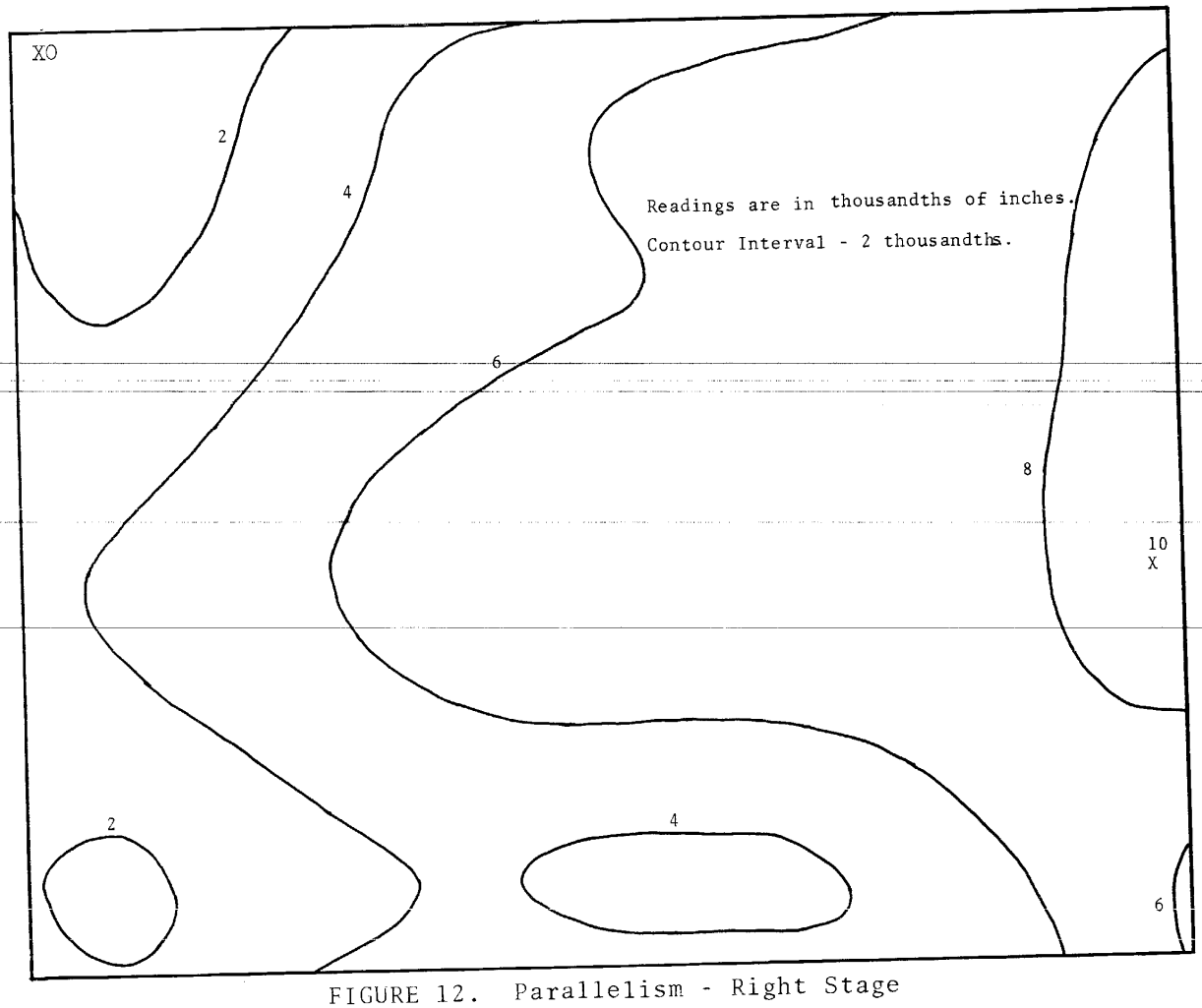

FIGURE 12. Parallelism - Right Stage

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